simply as a consequence of their great inherent velocity, the theory becomes admirably fitted to strengthen the views of Olbers, Zöllner and Bredichin with regard to the nature and the origin of the repulsive force acting upon the cometary matter. But the introduction of Maxwell's pressure of light gives rise to a number of difficulties which, as Prof. Arrhenius abundantly shows, can only be overcome by arbitrary and unwarranted assumptions.

I shall take an early opportunity of demonstrating the superiority of Zöllner's theory over the one which now claims to "sweep the astronomical horizon of so many mysteries."

Royal Observatory, Edinburgh. J. HALM.

Stopping down the Lens of the Human Eye.

MAY I be permitted to direct Mr. Wm. Andrews' attention to the fact that his experiment in "stopping down" the lens of the eye involves exactly the same principle as "orthoptics," of which every rifle-shot will have had experience.

The "orthoptic" consists of a round hole in a black disc, which replaces the lens of a pair of spectacles. The hole is generally adjustable in size, to suit varying conditions of light. The purpose of the orthoptic is to increase the *depth* of focus, enabling both back and fore sights and the target to be in sharp focus together. Persons with naturally large pupils will, as a rule, notice the effect more strongly. H. BLISS.

May 9.

IT may interest your readers to know that the principle referred to, under the above heading, in your issue of May 8 was adopted, a great many years ago, by the late Lord Sherbrooke, whose sight I believe was very defective. I remember seeing, about the middle of the seventies of the last century, at an exhibition of physical apparatus at South Kensington, a pair of spectacles which were said to have been invented by him for his own use. They consisted of two convex metal cups, closely resembling in shape and size the bowl of an ordinary tea-spoon. In the centre of each cup was a small pin-hole, which was the only aperture through which light could enter; and the two cups were fastened together by an elastic string, evidently intended to go over the head. The invention impressed me at the time as a remarkable example of scientific skill combined with great simplicity of contrivance.

GERALD MOLLOY.

The Evolution of Snails in the Bahama Islands.

IT seems desirable to call the attention of evolutionists to Dr. H. A. Pilsbry's monograph of the genus Cerion (or Strophia), just published in the "Manual of Conchology." The facts presented are most of them not new, but all that is known is set forth in great detail, with an abundance of excellent figures. Cerion is a genus of rather large cylindrical land-shells, for the most part inhabiting the Bahamas and Cuba. It has split up into innumerable local species and races, 134 of which are recognised as sufficiently distinct to bear names. Not only do even the smallest islands or "keys" produce distinct species, but frequently one small island will have two or more different forms inhabiting different parts, and sometimes a distinct race will occupy a very small area, surrounded on all sides by another type. The problem of the differentiation of the Achatinellidæ in the Hawaiian Islands is complicated by the complexity of their environment; but here in the Bahamas we have differentiation just as marked, with an environment—small sandy islands with palms and low bushes—as simple as we are likely to find anywhere. It would therefore seem that an excellent opportunity lies before some student of evolution to investigate exhaustively the local species and races of these Bahama snails, and determine what causes have brought about the known results. Colonies could be taken to new localities, and watched from year to year to see whether they became modified. The food and moisture conditions might be altered, and the results observed. The exact conditions surrounding each distinct form might be studied and described. Thus it might be determined whether the differentiation was the result of natural selection or has taken place independently of it. Such an investigation would be delightful work for some enthusiastic naturalist, especially with such an excellent guide in hand as Dr. Pilsbry has supplied. T. D. A. COCKERELL.

East Las Vegas, New Mexico, U.S.A., April 26.

Retention of Leaves by Deciduous Trees.

THE retention of leaves by beechen hedges referred to by your correspondent in NATURE, April 10, is by no means confined to those on elevated ground. It may commonly be observed in hedges of this tree whatever their situation. In Northumberland the beech is not infrequently used as a hedge, and always retains its leaves throughout the winter. Young beech trees also frequently retain their leaves, and by no means always in exposed situations. Indeed, the examples I have myself seen have been much more frequently in sheltered spots, as in plantations of older trees.

Nor is this phenomenon of deciduous trees retaining their leaves under certain conditions confined to the beech. It is, perhaps, equally common in the oak. Young oak trees in plantations may often be seen in the spring covered with brown and withered leaves. Larger trees may also sometimes be seen retaining the leaves on some of the *lower* branches, while the *upper* ones are bare. Travelling from Eastbourne to Victoria, soon after reading the above communication in NATURE, I noticed hundreds of young oaks covered with withered leaves. None of these were in elevated or exposed situations. Indeed, I am inclined to suggest, as an inference from the above facts, that it is rather the *protection* enjoyed by the trees which *enables* them to retain their leaves. In the one case the lesser height of the tree, and in the other the close intergrowth of the hedge, gives the wind less power to strip off the leaves. We can hardly consider that there is here a "protective device," unless on the part of the gardener who sets a beechen hedge to shelter his plants. G. W. BULMAN.

13 Vicarage Drive, Eastbourne, May 3.

WITH regard to the interesting communications concerning the retention of their leaves by young beeches, I beg to forward another possible solution. The beech is a "frost-tender" species, and early frosts, which would not rise high enough to affect large trees, would freeze the leaves of "small young" trees, thus preventing the formation of the abscission layer of cork at the base of the petiole. In such a case there is no reason why the leaves should fall off for a considerable time.

Leaves killed before the formation of this layer remain on the branch for an indefinite time, of which phenomenon pea-sticks cut in full leaf may serve as an example. P. T.

May 10.

THE RECENT VOLCANIC ERUPTIONS IN THE WEST INDIES.

NEWS of the terrible volcanic eruption in Martinique reached this country on Thursday last, and the details which have since become known have shown that an appalling disaster has occurred. St. Pierre, the chief commercial centre of the island, has been totally destroyed, and about thirty thousand people have perished. The eruption of Mont Pelée began on the night of Saturday, May 3, when large quantities of scoriæ and volcanic ash were thrown into the surrounding country. On Monday, May 5, a stream of lava is reported to have rushed down the side of Mont Pelée, following the dry bed of a torrent, and reaching the sea, five miles from the mountain, in three minutes. When the stream met the sea the water receded 300 feet on the west coast, returning with greater strength in a large wave.

Two days later, on May 8, a similar torrent of incandescent lava engulfed the town of St. Pierre. The following telegram describing the calamity was received at Paris from Fort de France on May 11, and was published in Monday's *Times*.

"The town of St. Pierre was destroyed on the 8th about 8 a.m. A terrible torrent of incandescent lava, from Mont Pelée, a volcano a few kilometres from the town, accompanied by a shower of fire, in a few seconds covered the town, and an immense furnace extended over the neighbouring coast, thus forming a line of fire from the village of Carbet to the town of Prêcheur. The effects of this volcanic torrent were felt as far as

Fort de France, and we received a shower of cinders and stones weighing seven to ten grammes. The whole island was covered three millimetres thick with cinders. The panic was general, yet relief was soon organised. The French cruiser *Suchet* went to the spot, as also other vessels towing boats, which soon returned, bringing terrifying news. The shore is unapproachable. The vessels in St. Pierre roads are on fire. The heat is extreme."

A later message from Fort de France, published in Wednesday's *Times*, says :—

"Access to the ruined town of St. Pierre has become more easy since the day before yesterday. At the Mouillage no signs of fire are now visible. Everything appears to have been rent and scattered as by a tornado. The iron gate of the Custom House remains standing. In the hospital the iron bedsteads are twisted, but bear no other traces of fire. The bed clothes and all other textile fabrics have completely disappeared. About 2000 corpses have been found in the streets. The central quarters of the town and the fort are buried under cinders to a depth of several yards. In the neighbourhood of the creek several houses remain intact, but the inhabitants were killed as if they had been struck by lightning, the bodies lying, sitting, or reclining in curiously diverse attitudes.

"Smoke is issuing from the crater of the volcano. Over the northern slope, as well as Basse Pointe, hover clouds of hot cinders, and flashes and rumblings are still distinguishable from time to time."

The Soufrière volcano in the neighbouring island of St. Vincent has also broken out in eruption. According to a *Times* telegram from St. Lucia, the northern district of St. Vincent, from Chateau Belair to Georgetown, has been devastated by an enormous flow of lava, destroying everything in its path. It is reported that both the large craters on St. Vincent are emitting enormous volumes of vapour, lava and hot ashes, and that small craters are bursting out everywhere. No vessel can approach the northern shore of the island on account of the intense heat and steam from the craters. Heavy ashes fell in great quantities on a steamer 250 miles from St. Vincent, and many masses of rock have fallen at Kingston. It is stated that sixteen hundred deaths have been caused in St. Vincent by the eruption.

This brief statement of the eruptions and their consequences contains the chief points of the news yet available. We are fortunate in being able to supplement the reports with an article by Prof. Milne upon the subject, and a summary in which he gives the sequence of events.

Sequence of Events.

April 19.—A very heavy earthquake occurred in Guatemala. It was recorded in the Isle of Wight, and might have been recorded anywhere in the world. It probably indicated a sudden adjustment in the orogenic fold of Central America, and a change in this fold possibly resulted in movements in the neighbouring fold represented by the West Indies, and hence the recent volcanic eruptions and earthquakes in that region.

April 23.—Mont Pelée showed a plume of "smoke."

May 3.—Mont Pelée not only "smoked," but at night was lighted up by the incandescent lava within its crater.

May 4.—Mont Pelée covered the surrounding district with ash.

May 5.—A stream of mud and lava were erupted and engulfed a sugar factory, twenty-three persons being buried. The sea receded 300 feet.

May 6.—A Government Commission issued a reassuring report.

May 7.—About 11 p.m. (Martinique time) a small earthquake from a very distant origin was recorded in the Isle of Wight, Edinburgh, and at other stations.

May 8.—At 8 a.m. "the rain of fire" destroyed St. Pierre. Ships were burned and sunk by a shower of rocks and heated materials, which poured down for about fifteen minutes. At Fort de France, twelve miles distant, these stones were the size of walnuts.

This eruption still continues, but on the 10th it had so far decreased that the site of St. Pierre was explored, but no living beings were seen.

The eruption of La Soufrière in St. Vincent commenced on Monday, May 5, and on May 7 the eruption was violent.

It would therefore seem that these two eruptions were simultaneous, and may have been brought about by a common cause.

Martinique, which, the *West India Pilot* tells us, is 35 miles in length and 7 to 16 miles in breadth, "is very lofty and irregular in height, and may be readily distinguished by three remarkable mountains of different forms, rising far above the general chain which runs through the whole of the island from N.W. to S.E., and may be seen about 45 miles off. The most northern of these is Mont Pelée, 4428 feet above the sea, rising nearly 4 miles to the south of Cape St. Martin, and its summit, when seen from a distance, appears rounded, and presents nothing remarkable."

It seems to be an irony of Nature that the most dangerous creations should so frequently simulate the appearance of that which is quite ordinary.

Prior to A.D. 79, Vesuvius was in its appearance even more innocent than Pelée. Spartacus and his gladiators camped within its crater, which, Plutarch tell us, was to a great extent covered with wild vines. On its flanks were cultivated fields, at its base the wealthy and populous cities of Pompeii and Herculaneum. If we except a few slight shocks which preceded the burial of these two towns, there was nothing to indicate the terrific outburst by which this was accomplished. The mountain, which was "nothing remarkable" in its appearance, suddenly exploded, there was a rain of ash, and the surrounding country became a desert.

Another illustration of the awakening of a slumbering Titan was Krakatoa. After a rest of 200 years, this mountain, on Sunday, May 20, 1883, gave symptoms of unrest by an eruption accompanied by shakings and roarings, which were loud enough to be heard even at a distance of 100 miles. Then for a few months there was comparative quiescence until August 26, when a crater opened near sea level and the challenged ocean poured in upon internal fires. The story of the battle which ensued, with its fearful detonations, which were heard at Rodriquez, 3000 miles distant, the appalling darkness created by black ash suspended in the atmosphere, the finer particles of which belted our globe and gave rise to brilliant and peculiar sunsets, the great sea waves which were formed to devastate surrounding coasts and destroy 36,000 lives, forms a well-known chapter in the history of vulcanology.

Pelée, the Hawaiian goddess who from her well of fire serves out molten rock for the consumption of those with whom she is angered, gives as spin drift from her molten fountains tresses of her glassy hair. Possibly the Pelée of the Antilles, although she has not sought an encounter with the oceans, may give to our atmosphere exhalations and glassy particles, the evidence of which will be seen in meteorological observations.

A third illustration of a mountain which to all who knew it was in its appearance as innocent as Primrose Hill, but without any premonitory warnings suddenly blew itself to pieces and changed the topography of the surrounding district, was Bandaisan, in central Japan. When, in 1878, the writer visited this mountain, to clamber through woods and vines with which its sides were covered and pass over a grass-covered depression at its summit where deer were browsing, the only indications that this round-headed hill might be included in the list of active volcanoes were that at its base there were some hot springs, whilst on its flanks a few pieces of scoria were seen. Ten years later, this apparently

peaceful mountain drove sixteen hundred million cubic yards of itself to such a height that many of the falling fragments struck the ground with such velocity that they were buried out of sight.

To know the extent to which the phenomena accompanying the eruption of Pelée find a parallel in those exhibited by her predecessors will be determined in the future. The probable loss of life, which it is to be hoped has been over-estimated, is given at 40,000. Whatever this number may be, it has been suggested that the same might have been reduced had the inhabitants of the stricken district taken warning from the slight earthquakes by which the great eruption was preceded. But may we not ask whether small earthquakes are not so frequent in the Windward Islands that were the inhabitants to fly with every tremor the Antilles would be depopulated?

Although the last great eruption of Pelée, which was one of frightful violence, occurred in 1851, statistics which do not take account of mere tremors credit the Island of Martinique, in an interval of twenty-six years, with 148 disturbances, whilst the Lesser Antilles generally are, during the same interval, credited with nearly 1200.

That volcanic outbursts are usually preceded by slight earthquakes is well known. How very slight these may be is testified by the tall and not too substantial buildings in Naples near the base of the almost continually erupting Vesuvius. Unfortunately, the occurrence of slight earthquakes is very much more frequent without, rather than with, volcanic outbursts. Many of the 1000 earthquakes which are annually recorded in Japan, two or three of which would shatter a London, are felt round the base of volcanoes, but it is only on rare occasions that they have been followed by disaster. Could science devise a means by which increasing pressure beneath a volcanic area could be measured, or could the crust of the same be rendered transparent, until familiarity ended in contempt, such areas would in all likelihood be sparsely populated; but so long as we cannot distinguish between the shakings which announce the abortive attempts of volcanoes to establish an opening and those tremblings and gurgitations which precede attempts that are successful, people will go on living as before.

One writer predicts great storms to follow the eruption. In August, 1891, a hurricane passed over Martinique, to be *followed* by an earthquake. The hurricane months for Martinique are July, August, September and October, when no doubt we shall have records of hurricanes both before and after earthquakes.

In considering the probable cause of this West Indian disaster, attention is drawn to the fact that the Lesser Antilles as seen on a chart are a group of islands running approximately from south to north, forming the outcrops of a suboceanic ridge. The western side of this ridge is steeper than the eastern, with the result that off Martinique, for example, at a distance of 5 or 6 miles there are soundings of 1200 fathoms, whilst on the opposite side such depths are not even found at distances of 50 miles off shore.

The steepness of this fold is such that earthquakes might be expected to originate along its western frontier, whilst volcanoes would occur along its ridge. Now it is chiefly along this western frontier that the cables pass. Those of Martinique, of which there are six, radiate from Fort de France. One goes northwards 12 miles, to end at the ill-fated St. Pierre. Three others also pass northwards to Guadeloupe, Dominica and St. Thomas. Another goes southwards to Paramaribo, and the last to St. Lucia, St. Vincent and other places.

Notwithstanding the existence of so many cables, communication with Martinique, and later with St. Vincent, was interrupted. At St. Pierre the cause of this was no doubt due to the avalanche of mud and lava which overwhelmed the town and roadstead. The cause of interruptions out at sea would be sought for in seismic convulsions, but of such disturbances of any magnitude there is no evidence. Since 8 a.m. (Martinique time) on the 8th, when St. Pierre was overwhelmed, until the 11th, seismographs in Great Britain have been at rest. That *small* earthquakes occurred is known, and it is just possible that some of these caused landslides sufficient to bury and damage the cables running along and across the steep suboceanic slopes described.

The cause of these earthquakes and the volcanic outbreak of Mont Pelée and of the Soufrière in St. Vincent—at which the last great eruption took place in 1812—probably results from some widespread rearrangement in the fold, the ridge of which is represented by these islands. The geological evidences pointing to elevations and depressions amounting to as much as 12,000 feet, and all within late Tertiary times, are found in the Barbados and other parts of the West Indies. If we assume that earthquakes are accelerations in these orogenic processes, and volcanic outbursts indicate that pressure has been relieved along the foldings they create, one inference is that the terrible disasters in the West Indies announce that a change has taken place in the configuration of the ridge which above the surface of the water is known as the Lesser Antilles.

Whatever may be the scientific inferences in connection with the great catastrophe, the situation it has created, which Byron might describe as one in which

> "Sires have lost their children, wives
> Their lords, and valiant men their lives,"

commands the heartfelt sympathy of the civilised world.

J. MILNE.

DOES CHEMICAL TRANSFORMATION INFLUENCE WEIGHT?

IN NATURE (vol. lxiv. p. 181, 1901) I directed attention to experiments by Heydweiller (*Drude Ann.*, vol. v. p. 394) from which he inferred that some chemical transformations, such as the solution of copper sulphate in water, were attended by real, though minute, changes of weight, and I pointed out certain difficulties involved in the acceptance of this statement. In connection with another subject, it has lately occurred to me that such changes of weight would really be in opposition to the laws of thermodynamics, and I propose now briefly to sketch the argument from which this opposition appears.

It is known [1] that by suitable arrangements the dissolution of salt may be effected reversibly at a given temperature. During the process, a certain amount of work is gained and a certain amount of heat at the given temperature has to be supplied. In the reverse process, of course, an equal amount of work has to be performed and an equal amount of heat is recovered. The temperature being given, these operations are not affected (it is assumed) by the height above the earth's surface at which they may be supposed to take place.

Conceive now that the temperature is uniform throughout and that the materials are initially at a low level and in one state (A). Let them be raised to a high level and there be transformed into the other state (B). Subsequently let them be brought down to the low level and transformed back into state A. The reverse transformations above and below compensate one another thermodynamically, and *if the weights are the same in the two states*, so do the operations of raising and lowering. But if the weights in states A and B are different, the cycle of operations may be so executed that *work is gained.*

[1] "On the Dissipation of Energy," NATURE, xi. p. 454, 1875; "Scientific Papers," vol. i. p. 238.